

STATE OF ALASKA

*Jay S. Hammond, Governor*



Annual Performance Report for

ENHANCEMENT OF SILVER  
SALMON STOCKS IN INTERIOR  
ALASKA WATERS THROUGH  
TRANSPLANTS OF SMOLTS FROM  
NURSERY LAKES

by

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## RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska  
Project No.: F-9-9  
Study No.: G-III Study Title: LAKE AND STREAM INVESTIGATIONS  
Job No.: G-III-J Job Title: Enhancement of Silver Salmon  
Stocks in Interior Alaska  
Waters Through Transplants of  
Smolts from Nursery Lakes

Period Covered: July 1, 1976 to June 30, 1977.

## ABSTRACT

This report summarizes all findings of this project since 1973 and discusses successes and problems that have occurred in rearing and stocking smolts from nursery lakes.

Age III silver salmon, Oncorhynchus kisutch (Walbaum), planted directly into Harding Lake from the hatchery achieved phenomenal growth for a landlocked lake, with fish weighing up to 4,387 g (9 3/4 lbs) and having fork lengths up to 672 mm being caught in 1976. These fish were in their terminal year.

Birch Lake was also sampled to evaluate growth and survival of nursery lake transplanted silver salmon smolts versus fingerlings planted directly from the hatchery.

## RECOMMENDATIONS

1. Continue monitoring survival and growth of transplanted smolts in Birch and Harding Lakes.
2. Conduct population estimates of silver salmon in Little Harding Lake to discern overwinter survival in absence of northern pike.
3. Compare relative survival of silver salmon transplanted from Little Harding Lake into Harding Lake versus silver salmon planted directly into Harding Lake from the hatchery.
4. Conduct food habit studies of the larger silver salmon in Harding Lake during the summer months to determine food preferences.

## OBJECTIVES

1. To assess growth and survival of transplanted silver salmon smolts in lakes having competing or predator species.
2. To rehabilitate waters suitable for nursery lakes.

## TECHNIQUES USED

Scales used for age determination were impressed on 20 mil acetate or mounted between glass slides. A Bruning 200 microfiche reader was used to read the scales. All fish were measured for fork length in millimeters.

Graduated mesh monofilament gill nets, 125' X 6' (38 X 1.8 m) with five mesh sizes ranging from 1/2" to 2 1/2" (12-64 mm) bar measure were used to sample fish populations in lakes.

## BACKGROUND

To determine the feasibility of rearing silver salmon, Oncorhynchus kisutch (Walbaum), to smolt size in Interior lakes and transplanting them into managed waters, two small lakes were selected and temporary weirs constructed at the outlets to capture silver salmon smolts if they exhibited smolting characteristics.

A brief description of the two lakes is as follows: Little Harding Lake, 45 miles south of Fairbanks on the Richardson Highway, with 45 surface acres and a maximum depth of 34'. The lake has a pH of 6.7 with a total alkalinity of 36 ppm. Small northern pike, Esox lucius Linnaeus, were present in the lake at the time of initial planting in 1972 but were eliminated in 1976 through the use of chemicals.

Lost Lake, 57 miles south of Fairbanks on the Richardson Highway, has 94 surface acres with a maximum depth of 39' and had been chemically rehabilitated prior to stocking in 1973. This lake has a pH of 7.1 with a total alkalinity of 31 ppm. The temporary weir structure on the lake's outlet was repeatedly tampered with by vandals and the lake became reinfested with lake chubs, Couesius plumbeus (Agassiz), in 1975.

No report was submitted for 1975 studies as work conducted was minimal. This report will summarize all findings of the project to date.

## FINDINGS

Little Harding Lake was stocked with 78,400 fingerling silver salmon, averaging 536/kg (243/lb) in August of 1972 (Table 1) concurrently with an extensive northern pike removal program carried out to reduce competition between the northern pike and silver salmon (Peckham, 1973). These silver salmon originated from eggs obtained from the Delta Clearwater River near Delta Junction, Alaska.

Table 1. Summary of silver salmon stocking into and recovery from nursery lakes.

Lake	Date	Origin of Stock	No. Stocked	Fish/ lb (kg)	Date Recovered	No. Recovered	Fish/ lb (kg)
Little Harding	8/29/72	Delta Clearwater, AK	78,400	243 (536)	5/22/73	20,207	36.3 (80)
	7/13/73	Green River, WA	40,000	440 (970)	---	0	---
	8/28/74	Seward, AK	40,570	120 (265)	5/28/75	2,301	14.0 (31)
	8/26-31/76	Blind Slough, Petersburg, AK	48,400	75 (165)	---	---	---
Lost	7/11-13/73	Green River, WA	200,820	440 (970)	5/31/74	18,567	49.3 (109)
					5/28/75	5,907	26.0 (57)

During May of 1973, 20,207 smolts were captured in a trap located in the outlet stream of Little Harding Lake and then transplanted into neighboring Harding Lake (Table 2). They were released in deep water to avoid northern pike in the littoral zone (Kramer, 1974). These smolts averaged 106 mm in length and 80/kg (36.3/lb) and represented 25.5% of the fingerlings stocked in 1972.

This exceptionally high return and very favorable growth rate (weight increase of 669%) indicated that the use of small lakes may be an economical and desirable way to enhance landlocked silver salmon stocks in Interior Alaska.

The 1973 smolts were caught as Age II fish during test netting operations in Harding Lake in November 1974. These were the largest silver salmon (363.1 mm) of this age we have observed to date (Table 3). For comparison, silver salmon fingerlings planted from the hatchery into Harding Lake in 1971 averaged only 150 mm as Age II fish in August 1973.

We were unable to determine what growth these 1973 smolts would have achieved in their terminal year (1975) since age data from that year was lost after collection; however, one terminal year fish of this stock that had remained in Little Harding Lake achieved a length of 470 mm and a weight of 1,362 g (3 lbs).

Following the transfer of the smolts to Harding Lake in 1973, Little Harding Lake was restocked with 40,000 silver salmon fingerlings at 970/kg (440/lb), the eggs of which were obtained from Green River Hatchery in Washington. The plant failed to take as there was no evidence of their presence during the remainder of 1973 and no smolts were captured in 1974.

In 1974, Little Harding was restocked with 40,570 silver salmon (eggs obtained from Bear Lake, Seward, Alaska) but only 2,301 smolts were captured in 1975. These smolts showed good growth, for they averaged 265/kg (120/lb) when planted and grew to 31/kg (14/lb) when they smolted. When captured in test nets in October 1976 they had attained an average length of 261 mm. In light of this poor smolt return, it was suspected that the northern pike population present in Little Harding Lake had built back up following an extensive pike removal program carried out in 1972 (Peckham, 1973). Studies indicated (Kramer, 1974) that northern pike in Little Harding Lake prey extensively on silver salmon fingerlings.

Little Harding Lake was chemically treated, in June 1976, with liquid rotenone at a concentration of 1 ppm to rid the lake of the northern pike population. After a 57-day detoxification period and 101 gill net days when no fish were captured, Little Harding Lake was restocked with 48,400 silver salmon (eggs obtained from Blind Slough near Petersburg, Alaska).

Test netting in Harding Lake in 1976 captured four age classes of silver salmon (Table 3). Age class III (planted directly from the hatchery as fingerlings) were mature fish that had achieved phenomenal growth for a landlocked lake, weighing up to 4,387 g (9 3/4 lbs) and ranging in

Table 2. Summary of silver salmon stocking in Harding and Birch Lakes, 1973-1976.

Lake	Year	No. Stocked from Hatchery	Age Class	No. Stocked from Nursery Lake	Age Class	Total
Harding	1973	149,000	0	20,207	I	169,300
	1974	0		0		0
	1975	372,400	0	2,301	I	374,701
	1976	697,500	0	0	--	697,500
Birch	1974	55,700	0	18,567	I	74,267
	1975	95,000	0	5,907	II	100,907
	1976	54,900	0	0	--	54,900

Table 3. Fish sampling summaries in lakes with both hatchery and nursery lake plants of silver salmon, 1973-1976.

Lake	Date	Age	No.	Length (mm)		Mean Weight (g)	Hatchery or Nursery Lake Plant
				Range	Mean		
Harding	8/10/73	II	25	145-155	150	...	Hatchery
	11/74	I	1	...	285	...	Hatchery
	11-12/74	II	8	335-410	363.1	567	Nursery Lake
		III	1	...	395	1,077.3	Hatchery
	10/2/75	0	45	100-120	108.2	...	Hatchery
		I	6	235-280	261.7	212.6	Nursery Lake
		II and III	5	290-370	322	504.6	Hatchery and Nursery Lake
	11/4-14/76*	0	3	105-118	111.0	...	Hatchery
		I	7	185-235	215.7	113.4	Hatchery
		II	23	210-370	261.0	232.5	Nursery Lake
		III	23	350-672	534.5	2,279.3	Hatchery
Birch	6-13-75	I	8	100-135	117.5	...	Hatchery
		II	22	235-275	251.4	...	Nursery Lake
	6-8-76	I	642	100-130	118.9	...	Hatchery
		II	131	190-285	232.6	110.6	Hatchery
		III	110	210-310	277.7	198.4	Nursery Lake

\* The number of silver salmon captured was 140 but data was non-randomly collected from 56 fish.



length from 356 mm to 672 mm (13.8" to 26.5") with an average of 534.5 mm (21"). These fish were originally obtained as eggs from Green River Hatchery in Washington. Back-calculated lengths at each year of life of these silver salmon are presented in Table 4.

### Lost Lake

In 1973, Lost Lake was stocked with 200,820 silver salmon fingerling at 970/kg (440/lb). These were the first fish stocked in the lake since its rehabilitation in 1970. The silver salmon were originally obtained as eggs from Green River Hatchery in the State of Washington.

During May and June of 1974, 18,567 silver salmon smolts averaging 96 mm in length and 109/kg (49.3/lb), a weight increase of 892%, were captured in a trap located in the outlet stream and transplanted into Birch Lake. The growth rate of these fish was good, but the number of smolt captured was low (due to insufficient flow in the outlet caused by an extremely low water table) and was not indicative of the fish remaining in the lake.

In 1975, 5,907 additional fish from this same stock averaging 57/kg (26/lb) and with a mean length of 116 mm were transferred from Lost Lake to Birch Lake again under low water flow conditions at the outlet. Attempts to capture additional fish with seines and fyke traps met with little success.

In June 1976, 12 of the remaining silver salmon were captured in Lost Lake; they had a mean length of 133 mm. These were Age III fish and would indicate very poor feeding conditions, as fish of this stock transplanted to Birch Lake had a mean length of 278 mm in 1976. Attempts are being made to upgrade the weir; subsequently, no other stocking will be made.

Birch Lake was test netted in 1975 and 1976 to monitor the growth of these transplanted fish. Table 3 indicates that the growth achieved by Birch Lake silver salmon smolts is not as good as the growth achieved by Harding Lake smolts. This can be attributed to competition from other fish in Birch Lake. Birch Lake was given a heavy direct plant of hatchery silver salmon fingerlings in an attempt to reduce a lake chub infestation.

### DISCUSSION

From the above, it has been shown that planting silver salmon fingerlings directly into Harding Lake has resulted in excellent terminal year fish, but this success has been verified for only one stock of fish to date. The transplants of smolts from little Harding Lake has also produced excellent results (to Age II), but also on a one-time basis. These results might be attributed not only to the use of nursery lakes, but also may be in part due to the use of a particular race of silver salmon (Delta Clearwater River).

Table 4. Back-calculated length at each year of life of silver salmon, Harding Lake 1976.

Age at Capture	N	Mean Fork Length at Annuli Formation (mm)		
		L 1	L 2	L 3
I	7	121		
II	23	103	183	
III	21	108	187	328
Weighted mean	(mm)	108	185	328
Length	(in)	4.3	7.3	12.9
Average annual	(mm)	108	77	143
Growth increment	(in)	4.3	3.0	5.6

It has been demonstrated that stocking high numbers (2,136/acre in Lost Lake) of fingerlings in a relatively infertile lake without competitor species can produce adequate growth to Age I; however, if large numbers remain in the lake after this age, growth will be severely limited.

In choosing lakes to be used as nursery lakes in programs such as this, it is important that the lake has adequate facilities for removal of the smolts.

#### LITERATURE CITED

Kramer, M. J. 1974. Inventory and cataloging of the sport fish and the sport fish waters in Interior Alaska. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1973-1974, Project F-9-6, 15(G-I-G):147-160.

Peckham, R. D. 1973. Evaluation of Interior Alaska waters and sport fish with emphasis on managed lakes. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1972-1973, Project F-9-5, 14(G-III-E):18-47.

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